

GPPD Vacuum System

Introduction

The GPPD sample well vacuum is controlled from the upper deck by a panel located in the center of the blue electronics rack. The control panel displays a block diagram similar to that shown in Figure 1 below:

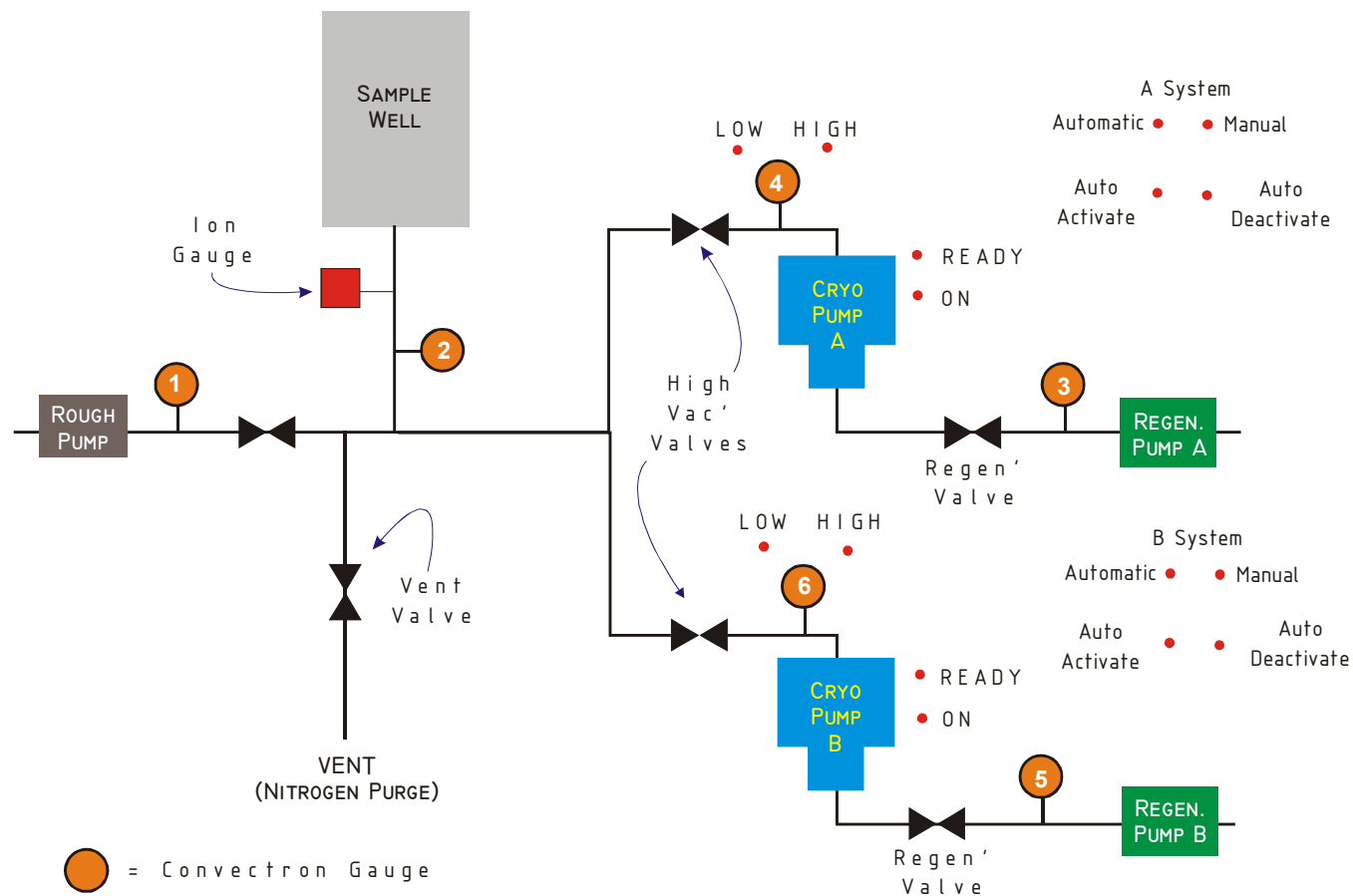


Figure 1

There are two levels of evacuation achievable with this system:

1. To around 2.00×10^{-3} Torr (achievable using the mechanical "Rough Pump")
2. To around 6.00×10^{-7} Torr (achievable using one of the two [or both] "cold trap" type "Cryo Pumps")

The first level is appropriate for room temperature experiments. For example: when using the Room Temperature Sample Changer.



The second level is required when using special low or high temperature ancillary equipment such as a displacer or furnace.

Note: *Certain positioning devices must not be used in a vacuum because their motors are not designed to operate in an evacuated environment. Devices like the Kappa Goniometer and the X-Y-Z-Phi do not seal the sample well when in place and therefore an evacuated sample environment is not achievable. Please do not engage the vacuum system when using these devices.*

Operation

The following procedures provide the most direct methods for operating the GPPD vacuum system. Please follow these procedures closely. Other methods may be used but are not recommended and may create delays in achieving proper vacuum levels.

Panel Switches:

To operate the switches on the panel, pull the tip of the switch actuator towards you and hold it out as you move the switch in the direction of your selection.

Note: *Always make sure that a sample-handling device is securely mounted in the GPPD Sample Well prior to operating any pumps.*

Rough Pump Only Operation

1. Close Vent (Nitrogen Purge) Valve (if not already closed).
2. Turn on Rough Pump (if not already on).
3. Open Rough Pump Valve.

Cryo Pump Operation

1. Close Vent (Nitrogen Purge) Valve (if not already closed).
2. Select "Automatic" (if not already on).
3. Turn Regeneration Pump "on" (if not already on).
4. Select "Auto Activate". [The correct pumps start automatically in sequence.]

Note: Cryo A and B can be run simultaneously if desired. But it is better to reserve one as a backup.



Sample Changing Procedures:

Note: These procedures apply only to devices that require removal of the entire device from the GPPD Sample Well in order to change the sample. Some devices have their own sample wells and therefore the vacuum in the GPPD Sample Well should be maintained during the sample change.

Sample change when using the Rough Pump only:

Release Vacuum

1. Close the Rough Pump Valve.
2. Open the Vent Valve (this will start the Nitrogen Purge, flooding the sample well with nitrogen to just above atmospheric pressure).

Removal and Replacement of Sample Handling Device

3. Observe the display for CG2. When the display stabilizes above 7×10^{-2} , perform the **Manual Vacuum Check** as described on **Page 4**.
4. When it is safe to remove the sample-handling device from the Sample Well, change the sample and then replace the sample holding device.

Re-engage Vacuum

5. Close Vent (Nitrogen Purge) Valve.
6. Open Rough Pump Valve.

Sample change when using a Cryo Pump:

Release Vacuum

1. Select Auto-Disable for the appropriate Cryo Pump system(s) (A and/or B).
2. Open the Vent Valve (this will start the Nitrogen Purge, flooding the Sample Well with nitrogen to just above atmospheric pressure).

Removal and Replacement of Sample Handling Device

3. Observe the display for CG2. When the display **stabilizes** above 7×10^{-2} , perform the **Manual Vacuum Check** as described on **Page 4**.
4. When it is safe to remove the sample-handling device from the Sample Well, change the sample and then replace the sample holding device.

Re-engage Vacuum

5. Close Vent (Nitrogen Purge) Valve.
6. Select Automatic Enable for the same Cryo Pump system(s) (A and/or B) used prior to the sample change.

Manual Vacuum Check

This procedure is to be used to verify that the Sample Well is at atmospheric pressure prior to removal of a sample-handling device.

1. Verify that the display for Convectron Gauge 2 (CG2) has **stabilized** above $7 \times 10^{+2}$.

This means no change in the display for at least three minutes.

No attempt to lift the device should be made to lift the device should be made until this condition is met!

2. Slowly and carefully use the jib crane to make the lifting straps almost taught. **Do not attempt to lift the device!**
3. Grab two or more lifting straps at a point just below the jib crane hook.
4. Squeeze the lifting straps in your hand/s in an attempt to gently leverage the device using the squeezing action only! If the Sample Well is at atmospheric pressure the device will lift up a few millimeters with relative ease. See illustration below:



5. If the device does not respond to this test, try grabbing one of the straps and carefully attempt to lift one edge of the device out of the Sample Well a few millimeters.
6. Once it is possible to slightly raise the device using careful manual lifting attempts, it is safe to remove the sample-handling device from the Sample Well using the jib crane.

Note: If the device does not respond to careful manual lifting attempts, seek assistance from NGS Operations personnel.



Remote Monitoring

To monitor the vacuum remotely enter the command “rdv” at the GPPD computer prompt. The various gauge read-outs will be displayed.

Example:

```
Data taken      21-SEP-2001 14:20:45
conv 1 - Chamber Rough Pump    1.20E-01 Torr
conv 2 - Sample Chamber        4.70E+02 Torr
conv 3 - Regen Pump A          7.00E-03 Torr
conv 4 - Cryo Pump A            9.20E-03 Torr
conv 5 - Regen Pump B           0.00E+00 Torr
Ion 1  - Sample Chamber        9.90E+09 Torr
```

If the Ion Gauge reads 9.90E+09 Torr, then it is “off”. To turn the Ion Gauge “on”, press the IG button next to the display panel.

Note: The Ion Gauge and its display will not remain “on” unless the vacuum is below 9×10^{-4} Torr. In this case, use Convectron 2 to monitor the Sample Well vacuum level.

Photos

The following photographs are provided to improve understanding of the system and it's operation.

Photo 1: Rough Pump

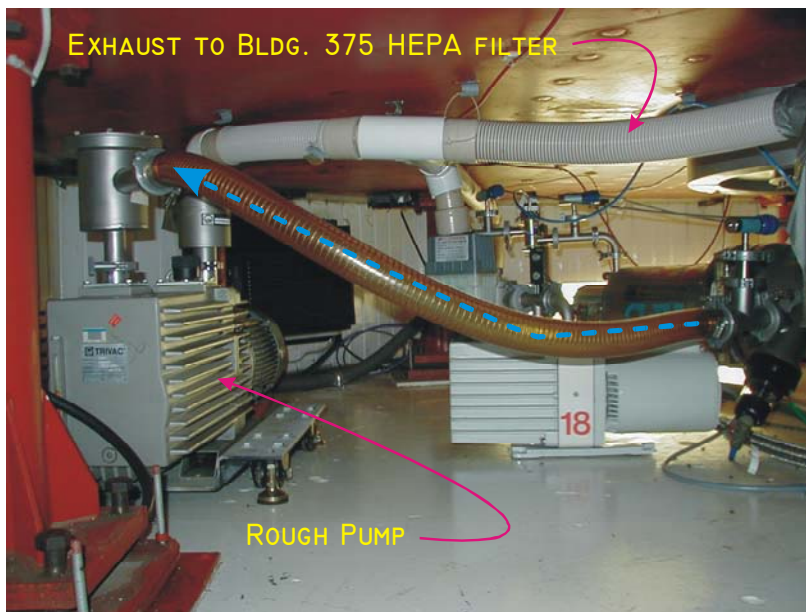


Photo 2: Regeneration Pumps

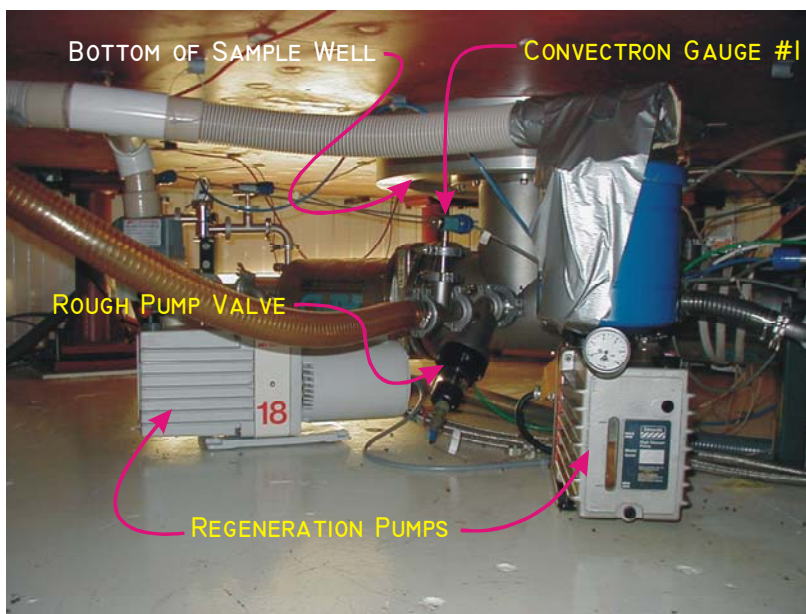


Photo 3: Valves and Gauges Detail

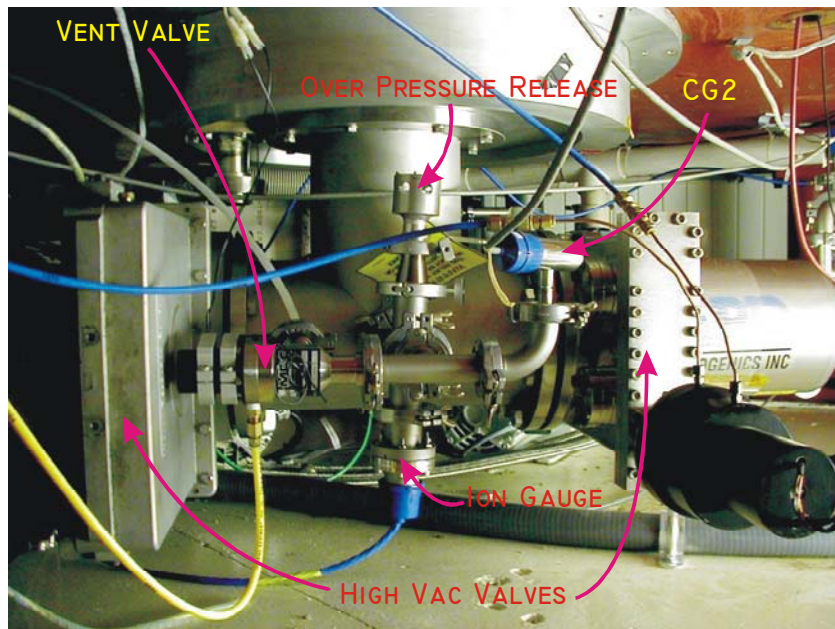
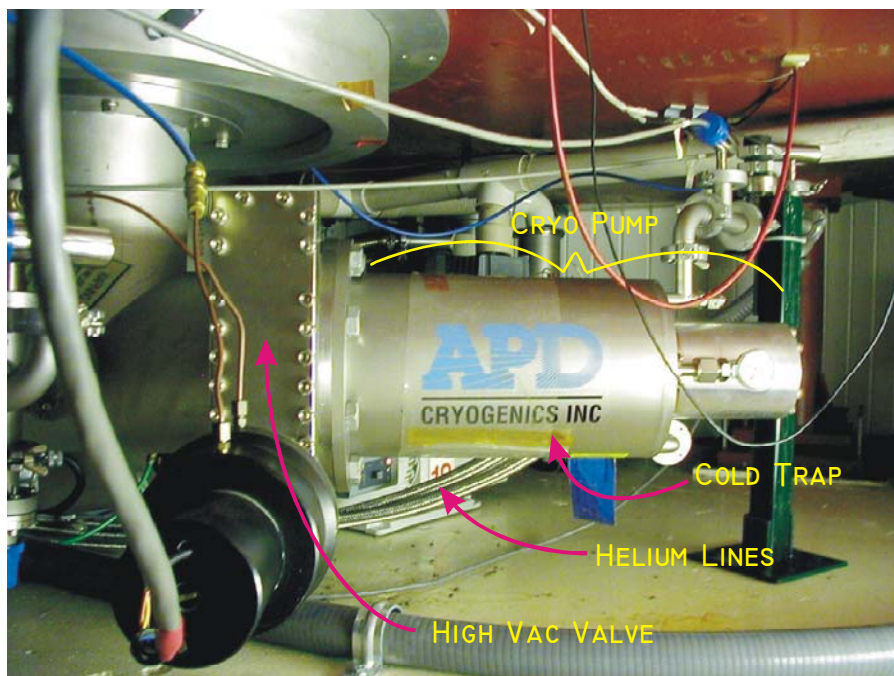


Photo 4: Cryo Pump



Maintenance & Troubleshooting

The following issues rarely, if ever, affect GPPD users/ visiting experimenters. These issues are presented here for reference purposes only.

NOTE:

Instrument personnel should always be contacted if any difficulty arises with any experiment!

Regeneration

GPPD instrument personnel regularly perform regeneration to “clean” the cold trap of material that was “trapped” during the evacuation process. This is normally done monthly, during normal shutdown periods.

However, regeneration will also be necessary if the Cryo Pump becomes contaminated from excess material due to a mishap or any accidental exposure to helium. This will be apparent if the Cryo Pump does not generate the expected vacuum level and no significant leaks are found. In most cases, if the problem is identified in time, the alternate or reserve Cryo Pump can be employed and the experiment can continue without undergoing a regeneration process.

Note: *A proper regeneration process will disable the Cryo Pump for many hours and requires periodic attendance and monitoring. Fortunately, it is possible to use one Cryo Pump while regenerating the other.*

1. Select Auto Disable
2. Turn off Cryo Pump
3. Turn on Regeneration Pump (if not already on)
4. Open the Regeneration Valve
The Cryo Pump will take about two hours to warm up and it is good to pump it for at least an hour after that. Therefore it is advisable to wait about three hours before attempting to use the Cryo Pump again.
5. Monitor the Convection gauge associated with the Cryo Pump undergoing regeneration. When the gauge reaches its limit and displays “all zeros”, the regeneration process can be considered complete.

Control Details

In the case where an incorrect switch has been engaged the following table may be used to interpret system operational delays or suspected malfunctions.


Table 1: Control Details

Item	Switch	LED	Interlock / Notes
Rough Pump	On / Off	On=On Off=Off	Cannot be turned off when any Cryo pump is active.
Rough Pump Valve	Open/ Closed	On=Open Off=Closed	Cannot be opened when any Cryo pump is active or if the vent valve is open.
Convector Gauge 1	N/A	Set Point Achieved	Shows vacuum level before RP valve. When RP valve is open, displays a similar value to CG2
Vent (Nitrogen Purge)	Open/ Closed	On=Open Off=Closed	Cannot be opened if RP valve is open or if either High Vacuum valve is open.
Convector Gauge 2	N/A	Set Point Achieved	Displays Sample Well vacuum level unless display is "all zeros". In this case use Ion Gauge to read vacuum.
High Vacuum Valve A	Open/ Closed	On=Open Off=Closed	Cannot be opened until Cryo Pump A achieves a "ready" state and both set points are met on CG4. Opens automatically in "automatic mode". Cannot be closed in Auto Mode.
Convector Gauge 4	N/A	(2) High & Low	LED's illuminate at high and low set points.
Cryo Pump A	On / Off	(2) On & Ready	"On" LED = Control logic is requesting the pump to operate. "Ready" LED = Cryo has been requested on for 2 hours.
Regeneration Valve A	Open/ Closed	On=Open Off=Closed	Cannot be opened with automatic mode enabled. Closes automatically in automatic mode.
Convector Gauge 3	N/A	Set Point Achieved	Shows vacuum level before Regeneration Valve. When valve is open, shows level of regeneration.
A Automatic Mode	On / Off	On=Auto Off=Manual	Manual mode A is not selectable until Auto Mode A is disabled.
A Auto Activate	On / Off	On=Activate Off=Deactivate	Will not engage until Rough Pump is active on sample well.
High Vacuum Valve B	Open/ Closed	On=Open Off=Closed	Cannot be opened until Cryo Pump A achieves a "ready" state and both set points are met on CG6. Opens automatically in "automatic mode". Cannot be closed in Auto Mode.
Convector Gauge 6	N/A	(2) High & Low	LED's illuminate at high and low set points.
Cryo Pump B	On / Off	(2) On & Ready	"On" LED = Control logic is requesting the pump to operate. "Ready" LED = Cryo has been requested on for 2 hours.
Regeneration Valve B	Open/ Closed	On=Open Off=Closed	Cannot be opened with automatic mode enabled. Closes automatically in automatic mode.
Convector Gauge 5	N/A	Set Point Achieved	Shows vacuum level before Regeneration Valve. When valve is open, shows level of regeneration.
B Automatic Mode	On / Off	On=Auto Off=Manual	Manual mode B is not selectable until High Vacuum Valve B is closed manually.
B Auto Activate	On / Off	On=Activate Off=Deactivate	Will not engage unless Rough Pump is active on sample well.
Ion Gauge	Push Button on Display	N/A	Press IG push button on display panel to display sample well vacuum level when GC2 is "off scale" (all zeros).